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Letters to the Editor

PROMPT publication of brief reports of important discoveries in physics may be secured by addressing them to this department. The closing date for this department is the third of the month. Because of the late closing date for the section no proof can be shown to authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents. Communications should not in general exceed 600 words in length.

Conductivity of Sodium-Ammonia Solutions

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RECENTLY Richard A. Ogg[1] has reported the occurrence of superconductivity in quickly frozen solutions of sodium in ammonia. In view of the fact that all other superconductors have transition points of the order of 5°K, corresponding to an excitation energy of 5×10^{-4} ev, the appearance of superconductivity at very much higher temperatures (about 200°K) is somewhat unexpected.

We have repeated Ogg's conductivity experiment on a number of concentrations ranging from $0.7N$ to $2N$ and noted in agreement with his work that the resistance drops very appreciably on freezing. However by making a current and potential measurement we found that the small residual resistance was caused by the solution itself, and not as Ogg suggests by a contact resistance at the electrodes.

It might be mentioned that Ogg's interpretation of the observed magnetic moment in a ring is not necessarily as conclusive as may appear at first sight. If a ring is frozen in a magnetic field and the field subsequently switched off, a magnetic moment due to paramagnetic regions within the material which have lost their ability to reorientate themselves could be mistaken for a persistent current. A more conclusive test is to freeze a ring in zero magnetic field and to attempt to induce a current by switching on and off a strong magnetic field. However, in a considerable number of experiments on rings with the concentration range stated above, we were unable to observe a residual magnetic moment with either technique of inducing a persistent current.

[1] Richard A. Ogg, Phys. Rev. **69**, 243 and 544 (1946

The Mass of the Neutron

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IN a recent Letter to the Editor on the above subject, K. Sun[1] has pointed out that if Bethe's[2] calculation of the mass of the neutron is repeated, using Mattauch's[3] more recent values for the H_2^1-D mass difference and the H^1 mass, a slightly lower neutron mass results. The value he obtains is $1.008\,92\pm 0.000\,04$ as compared to Bethe's $1.008\,93\pm 0.000\,05$. In the calculation, however, Sun used the same value as Bethe for the deuteron binding energy, namely 2.17 ± 0.04 Mev, the uncertainty in this quantity being the main source of uncertainty in the neutron mass.

The binding energy of the deuteron is now known more accurately than the above figure indicates and the more recent results should be used in the calculation. Wiedenbeck and Marhoefer[4] give 2.185 ± 0.006 Mev for the deuteron binding energy. This latter value, together with Mattauch's $0.001\,539\pm 0.000\,0021$ mass unit for the H_2^1-D difference, give the neutron-proton mass difference directly as $0.000\,807\pm 0.000\,0068$ or 751 ± 6.3 Kev. Using the H^1 mass of Mattauch ($1.008\,130\pm 0.000\,0033$), we then get a neutron mass of $1.008\,937\pm 0.000\,0075$. Thus the final mass, instead of being about 9 Kev lower than Bethe's value, and with an uncertainty of 37 Kev, is 6.5 Kev higher, with an uncertainty of only 7 Kev.

[1] K. Sun, Phys. Rev. **69**, 240 (1946).
[2] H. Bethe, Phys. Rev. **53**, 314 (1938).
[3] J. Mattauch, Phys. Rev. **57**, 1155 (1940).
[4] M. L. Wiedenbeck and C. J. Marhoefer, Phys. Rev. **67**, 54 (1945).

Transmission of Light by Superconducting Lead Films

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AMONG the properties of a substance which might be expected to undergo a change at the superconducting transition temperature are the optical properties. Hirschlaff[1] found, for visible light, no appreciable change in the reflectivity of tantalum and lead mirrors, as these passed reversibly through the superconducting transition. Daunt, Keeley, and Mendelssohn[2] showed that there is no measurable difference in the absorption of infra-red radiation in the region of 10μ at temperatures above and below the superconducting transitions of lead and tin.

Inasmuch as the foregoing results depended upon the interaction of the radiation with the surface layers, it was deemed worth while to check the light transmission of superconducting films. Lead films were evaporated at room temperature, upon polished fused quartz plates, and electrical leads were provided for resistance measurements. A representative square film had a resistance of 9.182 ohms at 300°K, 3.317 ohms at 80°K, 1.722 ohms at 20.4°K, 1.492 ohms at 10.1°K, and 0.000 ohm at 7.2°K. The light transmission was observed by two methods. (a) The films were uniformly illuminated by an incandescent bulb at such an intensity that the light transmitted was just visible. (b) The films were illuminated with light from a high pressure mercury arc, and the transmitted spectra was recorded photographically. The transmission was found to remain constant from 300°K to 5.1°K, i.e., down to 2° below the measured transition temperature.

As was to be expected from the work of Picard and Duffendack,[3] of Arni,[4] and of others, photomicrographs showed that the films were granular. It should be inter-